USEC Inc/ American Centrifuge Operating, LLC Air Emissions Annual Report Under Subpart H, 40 CFR 61.94 Calendar Year 2013

Site Name: American Centrifuge Plant

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Attachment 1 Certification

SECTION 1.0 FACILITY INFORMATION

The Portsmouth Reservation (PORTS) is owned by the Department of Energy (DOE) and was operated by DOE until July 1, 1993. In 1992, Congress passed legislation amending the Atomic Energy Act of 1954 (the Act) to create the United States Enrichment Corporation (USEC), a government-owned corporation, to operate the uranium enrichment enterprise in the United States. The corporation began operation on July 1, 1993. In accordance with the Act, USEC leased the production facilities at PORTS and its sister plant at Paducah, Kentucky from DOE. DOE retained operational control of most waste storage and handling facilities as well as all sites undergoing environmental restoration. In keeping with the Act, on July 28, 1998, the U.S. Department of the Treasury sold the uranium enrichment enterprise through an Initial Public Offering to create USEC Inc. The original corporation, USEC, became a wholly owned subsidiary of USEC Inc and continued to operate/maintain the two uranium enrichment plants.

In May 2001, USEC ceased uranium enrichment in the Gaseous Diffusion Plant (GDP) at PORTS. USEC continued to operate transfer facilities and certain support facilities at PORTS for the purpose of removing technetium from off-specification uranium hexafluoride (UF₆) feed material. USEC also continued to remove uranium deposits from the GDP cascade under contract to DOE.

In addition, USEC Inc installed and operates the American Centrifuge Lead Cascade (LC) in existing buildings at PORTS. This is a pilot plant and demonstration facility for a new centrifuge-based commercial enrichment plant to be built on the site of, and re-using much of the infrastructure of, DOE's cancelled Gas Centrifuge Enrichment Plant (GCEP). The LC operates on total recycle to generate operating and economic data and is limited by its NRC License to a total of 250 kg of UF₆ in the entire system. USEC Inc initiated operations at the LC in 2006. USEC Inc has received an NRC License for a follow-on commercial American Centrifuge Plant (ACP) but this plant is not yet constructed.

In 2010, DOE awarded a contract for the final Decontamination and Decommission (D&D) of the GDP to a Fluor / Babcock & Wilcox joint venture named FBP. USEC returned the facilities containing the GDP monitored vents to DOE and FBP at the end of March, 2011. The unmonitored GDP sources were returned to DOE and FBP at the end of September, 2011. USEC Inc retained only the LC and the future ACP.

In 2012, USEC Inc entered a cost-sharing contract to install and operate a commercial scale demonstration cascade under the LC license. This demonstration cascade began initial operation in March 2013 and completed its test program at the end of December 2013.

In February 2013, USEC Inc reorganized its Portsmouth operations into a wholly owned subsidiary named American Centrifuge Operating, LLC (ACO). This is an administrative change with no impact on plant operations or staffing.

At the end of 2013, PORTS contained three largely independent plants. The largest and oldest is the GDP, which is under the control of DOE and its D&D contractor, FBP. A deconversion plant, which is converting accumulated depleted UF6 to uranium oxide and hydrofluoric acid for disposal and/or sale, is under the control of DOE and its operating contractor Babcock & Wilcox

Conversion Services (BWCS) on the west side of the site. ACO operates the LC and will operate the future ACP in the southwest corner of the site.

The management of the DOE activities is completely separate from the USEC Inc/ACO activities. For this reason, DOE submits its own annual report on its activities, including the GDP sources from 2011 onward. USEC Inc/ACO submits a separate report that includes only the LC and ACP activities. Both reports include the public dose due to all site releases, in accordance with USEPA direction.

1.1 Site Description

The PORTS site is located in sparsely populated, rural Pike County, Ohio, on a 16.2-km² (6.3-mile²) site about 1.6 km (1 mile) east of the Scioto River Valley at an elevation of approximately 36.6 m (120 ft) above the Scioto River floodplain. The terrain surrounding the plant, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops such as corn and soybeans.

Pike County has a generally moderate climate. Winters in Pike County are moderately cold, and summers are moderately warm and humid. The precipitation is usually well distributed with fall being the driest season. Prevailing winds at the site are out of the southwest to south. Average wind speeds are about 5 mph (8 km/h) although winds of up to 75 mph (121 km/h) have been recorded at the plantsite. Usually, high winds are associated with thunderstorms that occur in spring and summer. Southern Ohio lies within the Midwestern tornado belt, although no tornados have struck the plantsite to date.

Pike County has approximately 28,709 residents (2010 census data). Scattered rural development is typical; however, the county contains numerous small villages such as Piketon, Wakefield, and Jasper, which lie within a few kilometers of the plant. The county's largest community, Waverly, is about 19 km (12 miles) north of the plantsite and has a population of approximately 4,408 residents. Additional population centers within 80 km (50 miles) of the plant are Portsmouth (population 20,226), Chillicothe (population 21,901), and Jackson (population 6,397). The total population of the area lying within an 80-km (50-mile) radius of the plant is approximately 677,309.

1.2 Source Description

1.2.1 Radionuclides Used at the Facility

USEC Inc originally introduced UF₆ to the LC in October 2006. The LC operates on total recycle to generate process operating and economic data and uses a single 250 kg batch of UF₆ for its entire feedstock. The feedstock for the LC was specifically selected to be free of other radionuclides, so detectable levels of radionuclides other than the three naturally occurring uranium isotopes and their short-lived daughters are not anticipated. The follow-on commercial plant will use feedstock that complies with the ASTM standard for UF₆ feedstock, so detectable levels of other radionuclides, such as ⁹⁹Tc, in its emissions will be possible though still not expected.

The uranium fuel cycle has been widely contaminated with ⁹⁹Tc from recycled reactor fuel and ⁹⁹Tc emissions from the GDP sources at PORTS are an established fact. For this reason, USEC Inc has historically presumed a ⁹⁹Tc release at least equal to the vent sampler detection limit from all monitored vents, including the LC vent. As of 2013, both operational knowledge and monitoring results indicate that the LC has no ⁹⁹Tc to emit and USEC Inc has no responsibility for any other active radionuclide emission source at PORTS. For this reason, USEC Inc/ACO will continue to monitor its vents for ⁹⁹Tc, but will not assume ⁹⁹Tc is present unless it is detected.

ACO also uses a variety of sealed sources for calibration of equipment; however, none of this results in material releases and therefore is not used in the determination of the public dose.

1.2.2 Monitored and Unmonitored Sources

The LC has only one radiological vent, while the future ACP will have a total of six, including the current LC vent (see Table 1 below). All of these vents are or will be sampled continuously when operating by flow-proportional, isokinetic samplers to provide emissions data. In addition, these sources are or will be monitored in real-time by gamma detectors mounted on the continuous emission samplers to provide real-time information for process operations. Laboratory analysis of the emission samples is more sensitive, more accurate, and more reliable than the gamma detectors but cannot provide real-time data required for process control.

Table 1.0 ACO Monitored Emission Points

Location	Vent Identification Number
X-3001 North Purge Vacuum/Evacuation Vacuum Vent	X-3001-A-3111 (LC)
X-3001 South Purge Vacuum/Evacuation Vacuum Vent	X-3001-A-3115 (future use)
X-3002 North Purge Vacuum/Evacuation Vacuum Vent	X-3002-A-3116 (future use)
X-3002 South Purge Vacuum/Evacuation Vacuum Vent	X-3002-A-3117 (future use)
X-3346 Evacuation Vacuum Vent	(Not yet installed)
X-7725 Gas Test Stand Purge Vacuum/Evacuation Vacuum Vent	X-7725-A-3118 (future use)

1.2.2.1 Monitored Sources

American Centrifuge Lead Cascade

The LC is installed in the existing X-3001 Process Building and uses the existing X-3001 North Purge Vacuum/Evacuation Vacuum (PV/EV) Vent. The LC is a demonstration facility licensed by the NRC for up to 240 individual centrifuges and up to 250 kg of UF₆. The purpose of the LC is to generate operability and economic data for a follow-on commercial uranium enrichment plant. The LC operates on full recycle with no UF₆ being withdrawn except samples for

laboratory analysis. The LC's entire UF₆ inventory was transferred at one time from the GDP prior to LC operations.

X-3001 North Purge Vacuum/Evacuation Vacuum

The X-3001 Process Building is one of two process buildings constructed for DOE's Gas Centrifuge Enrichment Plant in the 1980's. USEC Inc has installed the LC, a demonstration and pilot plant for a new gas centrifuge-based uranium enrichment plant, in the north end of X-3001. The PV/EV Vent is the only radiological vent associated with the Lead Cascade. The high-speed centrifuges in the LC operate within a vacuum to eliminate gas friction and heating effects. The PV/EV systems exhaust light gases (e.g., air) from the centrifuge's outer casing. The EV system is an intermittent system used to establish the necessary vacuum in new centrifuges prior to startup. The PV system is a continuous system used to maintain the vacuum within operating centrifuge casings. Both systems share a common vent. Gases evacuated by the PV/EV Systems are vented through chemical adsorbent traps and exhausted to the atmosphere through a monitored roof vent.

American Centrifuge Plant

The ACP will have a total of six process vents: four process building PV/EV vents (including the current Lead Cascade vent), a fifth PV/EV vent supporting a test stand with a small number of machine positions, and an Evacuation Vacuum (EV) vent for all process feed and withdrawal operations. All six of these vents will have continuous vent monitors. Like the LC, the ACP PV/EV systems will re-use existing building vents. The feed and withdrawal operation has been extensively re-designed from the original GCEP design to minimize the presence of liquid UF₆ however. As a result, the EV system will use a completely new building vent that has not yet been installed. The ACP construction is on hold at the end of 2013. USEC Inc intends to resume construction when financing becomes available.

1.2.2.2 Unmonitored and Potential Sources

Neither the LC nor the ACP is expected to have any unmonitored airborne emissions. The only potential for such an emission would be in the ventilation exhausts. The workplace air in uranium handling areas is monitored under the Radiation Protection Program and is reviewed at least quarterly by Environmental to verify that airborne concentrations in the ventilation systems have remained insignificant.

SECTION 2.0 AIR EMISSIONS DATA

Table 2.0 summarizes the control device information for each source and gives the distance and direction from each source to the nearest resident, school, office or business, and vegetable, meat, and milk-producing farms.

2.1 Radionuclide Emissions from Point Sources

The dominant radionuclides in the LC vent are the three natural uranium isotopes, ²³⁴U, ²³⁵U and ²³⁸U, and their short-lived thorium and protactinium daughters, ²³¹Th, ²³⁴Th and ^{234m}Pa. Releases are limited to leakage from the enrichment process into the supporting vacuum systems and are usually less than the vent sampler detection limit. ACO assumes some uranium is present in the vent and conservatively reports these releases as equal to the detection limit. ACO also assumes that the short-lived daughters are present in equilibrium with their respective parent nuclides.

The uranium fuel cycle has historically been widely contaminated with ⁹⁹Tc from recycled reactor fuel and ⁹⁹Tc emissions from the GDP sources at PORTS are an established fact. For this reason, USEC Inc historically presumed a ⁹⁹Tc release at least equal to the vent sampler detection limit from all monitored vents, including the LC vent. Both operational knowledge and monitoring results indicate that the LC has no ⁹⁹Tc to emit and, as of 2011, USEC Inc/ACO has no responsibility for any other active radionuclide emission source at PORTS. For this reason, ACO continues to monitor its vent for ⁹⁹Tc, but no longer assumes ⁹⁹Tc is present unless it is detected.

2.2 Radionuclide Emissions from Fugitive and Diffuse Sources

There were no significant emissions of radionuclides from diffuse or fugitive sources at PORTS due to USEC Inc operations.

Table 2.0 ACO Point Sources

		Veg.	9270 ENE	9380 ENE	9090 ENE	9200 ENE	9270 ENE	
	Farm	Meat	1550 SSE	1340 SSE	1470 SSE	1250 SSE	1720 SSE	
Distance in <u>Meters</u> to the Nearest:		Mik	4450 N	4690 N	4450 N	4700 N	4300 N	
tance in <u>Meters</u>	Office or	Business	1320 WSW	1230 WSW	1500 WSW	1420 WSW	1330 WSW	led
Dist	School		5110 N	5330 N	5110 N	5360 N	4960 N	Not yet installed
Dis	Resident		1080 W	1100 WNW	1280 W	1170 S	1010 W	
Control		O.95% ^c NA NA NA				AN A		
	Control Device		Chemical Adsorbents	Not yet in operation				
	Point Source ^a		X-3001 North PV/EV Vent	X-3001 South PV/EV Vent	X-3002 North PV/EV Vent	X-3002 South PV/EV Vent	X-7725 Gas Test PV/EV Vent	X-33346 EV Vent

concentrations above 1 ppm. Below this concentration, chemical adsorbents have reduced efficiency or no effect. Normal concentrations entering the PV/EV Chemical Traps are near or below 1 ppm. The sample traps (which follow the control Chemical adsorbents (such as activated alumina and sodium fluoride) are approximately 95 percent effective at traps) use activated alumina hydrated to 14 percent moisture content, which is much more effective due to an instantaneous reaction of gaseous UF_6 and $^{99}\mathrm{Tc}$ with the water to form particulate matter.

Table 2.1 ACO Releases (in Curies) During CY 2013

NU	4,232,000			USEC Inc Sources	40		
CLIDE	X-3001 North PV/EV	X-3001 South PV/EV	X-3002 North PV/EV	X-3002 South PV/EV	X-7725 Gas Test PV/EV	X-3346 EV	Total
234 U	2.12E-6						2.12E-6
235 U	9.98E-7						9.98E-7
238 U	1.55E-6						1.55E-6
99 Tc	0.0	No sources connected to vent	No sources connected to vent	No sources connected to vent	No sources connected to vent	Vent not installed	0.0
231 Th	9.98E-7						9.98E-7
234 Th	1.55E-6						1.55E-6
234m Pa	1.55E-6						1.55E-6

SECTION 3.0 DOSE ASSESSMENT

3.1 Description of Dose Model

The radiation dose calculations were performed using the CAP88 package of computer codes. This package contains USEPA's AIRDOS-EPA computer code. This program implements a steady-state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides. It also includes Regulatory Guide 1.109 food chain models to calculate human exposure, both internal and external, to radionuclides deposited in the environment. The human exposure values are then used to calculate the Effective Dose Equivalent (EDE). Beginning with the 2013, CAP88-PC Version 4 is being used. This version uses updated dosimetry and has better compatibility with the Windows 7 operating system.

3.2 Summary of Input Parameters

Except for the radionuclide parameters given in Section 2.0 and those provided below, all important input parameter values used are the default values provided with the CAP88-PC, Version 4 computer codes and data bases. Meteorological data is taken from an onsite weather station with instrument packages at the 60-, 30-, and 10-meter levels with rain gauges at ground level. The ACP only uses the 30-meter and rainfall data. The 2013 meteorological data was not available to ACO. With USEPA permission ACO modeled its 2013 releases using a compilation of the onsite data over 2008 through 2012. The STAR format frequencies over the five year period were averaged to generate a composite STAR array to be used as input to the GETWIND utility. In addition, the .WND files (GETWIND output) from the same five years were averaged as appropriate (e.g., the reciprocal-average wind speeds were reciprocally averaged while the arithmetic-average wind speeds and frequencies were arithmetically averaged). In the end, ACO used the composite .WND file for the official CAP88 input. The additional weather data listed below were also averaged over the previous five years.

Solubility Class: All uranium isotopes:

AMAD:

Technetium-99 F
All uranium daughters M
1 µm

Meteorological data: 2008-2012 data from onsite tower

Rainfall rate: 107 cm/year Average air temperature: 12.6 °C Average mixing layer height: 559 meters

Fraction of foodstuffs from: Vegetables and produce	Local Area 0.700	Within 50 mi 0.300	Beyond 50 mi* 0.000
Meat	0.442	0.558	0.000
Milk	0.399	0.601	0.000

*The dose estimate for foodstuffs is very conservative when 0.0 is used as an input parameter in the category of foodstuffs consumed that were produced at a distance of 50 miles or more from the PORTS site. Realistically, the majority of the local foodstuffs consumed are purchased at local supermarkets that receive their stock from all over the world.

3.3 Source Characteristics

Table 3.0 ACO Source Characteristics

Source	Туре	Release Height (m)	Inner Diameter (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (°C)		
X-3001 N PV/EV Vent	Point	30	0.10	5.8	26.7		
X-3001 S PV/EV Vent	Point	30	0.10	No source c	onnected to vent		
X-3002 N PV/EV Vent	Point	30	0.10	No source connected to vent			
X-3002 S PV/EV Vent	Point	30	0.10	No source connected to vent			
X-7725 PV/EV Vent	Point	28	0.10	No source connected to vent			
X-33346 EV Vent	Point		Vent n	not installed			

3.4 Compliance Assessment

In 1996, USEPA authorized USEC Inc and DOE to submit separate reports for their areas of responsibility. However, each entity was directed to include the other's dose assessment values in its report in order to show the plant's total effect on the public and the entire site's compliance status with the EPA public dose limit. In 2011, the bulk of USEC Inc's emission sources were transferred back to DOE. As a result, DOE is expected to dominate site emissions and the public dose for at least the next few years.

The most exposed member of the public received a total EDE of 0.047 mrem/yr $(4.7 \times 10^{-4} \text{ mSv/yr})$ from total site operations in 2013. USEC Inc operations contributed only 1.8×10^{-6} mrem/yr $(1.8 \times 10^{-8} \text{ mSv/yr})$ to the total. This individual is also the most exposed member of the public due to DOE operations and was located 3170 meters north of DOE's predominant emission source, the X-627 Groundwater Treatment Facility. This individual was located 4339 meters north from the LC.

The most exposed member of the public to USEC Inc operations received 3.0×10^{-6} mrem/yr $(3.0 \times 10^{-8} \text{ mSv/yr})$ from LC emissions in 2013. This individual was located 1234 meters south of the LC. This individual also received 0.014 mrem/yr $(1.4 \times 10^{-4} \text{ mSv/yr})$ from DOE operations and was located 2530 meters south-southwest of the X-627 Groundwater Treatment Facility.

SECTION 4.0 ADDITIONAL INFORMATION

4.1 Collective EDE (Person-Rem/Yr)

Table 4.0 gives the Collective EDEs (i.e., Population Doses) in person-rem/yr due to USEC Inc/ACO operations over the past ten years. The Collective EDEs are given for the 50-mile radius population and the village of Piketon and the individual EDEs for the most exposed individual (MEI) due to USEC Inc operations are also given for comparison.

Because of the change in USEC Inc/ACO's responsibilities, Table 4.0 lists the public doses due to combined LC and GDP emissions through 2010, and the corresponding public doses from the LC alone from 2007 through the present year. Public doses from the LC have consistently been much lower than the GDP doses so there is no way to observe any trend in LC releases without separating the LC doses out. In addition, the effects of the presumed ⁹⁹Tc emissions have been removed from the pre-2011 Lead Cascade public doses.

Table 4.0 Annual Doses Due to USEC Inc/ACO Airborne Emissions, 2004-2013 1

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	EPA Std
50-mile	0.14	0.013	0.014	0.077	0.10	0.14	0.81				374
Collective EDE ^{2,4}	Lead Cas	cade only		5.9x10 ⁻⁵	6.5x10 ⁻⁵	7.1x10 ⁻⁵	3.9x10 ⁻⁵	3.8x10 ⁻⁵	5.3x10 ⁻⁵	4.6x10 ⁻⁵	NA
Piketon	0.018	0.0021	0.0037	0.0024	0.0051	0.0046	0.028				
Collective EDE ^{3,4}	Lead Cas	cade only		2.3x10 ⁻⁶	2.7x10 ⁻⁶	2.5x10 ⁻⁶	1.7x10 ⁻⁶	2.1x10 ⁻⁶ 2	2.1x10 ⁻⁶	2.1x10 ⁻⁶	NA
MEI EDE ⁵ (mrem/yr)	0.025	0.0029	0.0045	0.0034	0.0053	0.0069	0.051				
	Lead Cas	cade only		3.4x10 ⁻⁶	3.4x10 ⁻⁶	2.8x10 ⁻⁶	2.3x10 ⁻⁶	2.6x10 ⁻⁶	3.7x10 ⁻⁶	3.0x10 ⁻⁶	10

Notes to Table 4.0:

- 1. All dose figures in this table are for USEC Inc/ACO operations only. Prior to 2011 this included both GDP and American Centrifuge Program operations. From 2011 onward USEC Inc/ACO operations are limited to American Centrifuge Program operations.
- 2. Collective EDE in person-rem/year for 50-mile radius. This is a summation of the dose to each individual living within a 50-mile radius.
- 3. Collective EDE in person-rem/year for the Village of Piketon. This is a summation of the dose to each individual living within the village.
- 4. Population distributions for calendar year 2009 and earlier are based on 2000 census data.
- 5. Population distributions for calendar year 2010 and later are based on 2010 census data.
- 6. The most exposed individual (USEC operations only) in 2013 was located 1234 meters south of the LC.

4.2 New/Modified Sources

USEC Inc did not install any new radionuclide sources or modify any existing ones in 2013.

4.3 Unplanned Releases

No major unplanned releases to the atmosphere occurred during calendar year 2013.

Minor releases can occur within workspaces during attaching and detaching of lines to cylinders, maintenance on process systems and when other off-normal conditions developed. These releases are controlled by the use of HEPA filtered gulpers. Workplace air monitoring is used to verify that radionuclide concentrations in workplace air are insignificant.

SECTION 5.0 SUPPLEMENTAL INFORMATION

5.1 Radon Emissions

The LC does not have and does not expect to have any ²²⁰Rn emissions due to ²³²U or ²³²Th sources. The LC does not manage any ²³²U and consequently does not have any emissions of ²²⁰Rn due to ²³²U decay. The LC does not specifically manage ²³²Th, some amount could be present due to ²³⁶U decay and feedstock contamination. ²³⁶U is itself a trace component of the uranium managed at PORTS, has never been detected at the LC, and its thorium daughter is extremely long-lived (with a half-life greater than 14 billion years). These figures indicate that no measurable concentrations of ²²⁰Rn due to ²³²Th decay will exist at the LC within any foreseeable future.

The uranium processed at PORTS has previously been chemically purified at the mill to remove all naturally occurring elements including ²²⁶Ra, which is the precursor of ²²²Rn. It has been calculated that 10,000 years would be required before detectable levels of ²²²Rn would occur due to the natural decay process.

5.2 Compliance with NESHAP Subpart H Requirements

Prior to 2011, USEC Inc and its subsidiary USEC had continuous emissions monitors (samplers) on sixteen point sources of the 38 point/grouped sources that represent what were historically the major emission sources at PORTS. USEPA-Region 5 conducted a detailed inspection of the vent sampling program during its NESHAP inspections during the weeks of March 15, 1993, and July 22, 1996. Although not explicitly stated in the final inspection reports, USEPA-Region 5 has accepted the stack sampling methodology as complying with the requirements of 40 CFR 61.93(b). Further USEPA inspections of this program were conducted in 1994, 1995, 1998, 2000, and 2006 and also accepted the sampling methodology. Finally, the sampling methodology was approved for use at the LC in 2004 and in the Approval-to-Construct the ACP in 2007.

5.3 Future Facilities

In August 2004, USEC Inc submitted a license application to the NRC for a commercial uranium enrichment plant, the ACP. The commercial plant will initially be installed in the existing GCEP buildings with some new construction (two new support buildings and some new cylinder storage pads). The NRC issued a Construction and Operating License for this plant on April 13, 2007. NESHAP Approval to Construct the ACP was issued Oct 1, 2007. Construction began shortly thereafter and continued through mid-2009. At that time, funding issues delayed further work on the ACP. USEC Inc intends to resume construction when financing becomes available. Radioactive material cannot be introduced to the ACP prior to passing an NRC Operational Readiness Review.

Attachment 1

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and a complete representation of the emissions under United States Enrichment Corporation's control. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (see 18 U.S.C. 1001).

Name:

Daniel Rogers

General Manager

American Centrifuge Operating, LLC

Date: 5-30-14